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THE UTILITY OF NON-LETHAL WEAPONS IN LARGE-SCALE CONFLICT

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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## **Introduction**

In the last decade of the 20<sup>th</sup> century, the United States (U.S.), as the only remaining superpower with global reach, found itself embroiled in conflicts of varying magnitude. In Operation Desert Storm, U.S. armed forces dazzled a worldwide audience with an overwhelming display of precision lethal force. This was in sharp contrast to the public assessment of American military efforts in small, low-intensity conflicts such as Somalia and Kosovo.

The performance of U.S. forces in these varied circumstances has provided “grist for the mill” in the ongoing debate about the future role of the U.S. military in world affairs. This debate has centered on two core issues: a) the nature of future armed conflicts, and b) the suitability of America’s vast conventional arsenal in these situations.

Some students of these issues predict that American participation in major regional conflicts is a thing of the past:

“Like a man who has been shot in the head but still manages to stagger forward a few paces, conventional warfare may be at its last gasp. As low-intensity conflict rises to dominate, much of what has passed for strategy during the last two centuries will be proven useless. The shift from conventional war to lower-intensity conflicts will cause many of the most powerful and most advanced weapons to be consigned to the scrap heap.”<sup>1</sup>

Rather, they foresee the United States assuming the mantle of a global policeman, involving itself in frequent military operations other than war (MOOTW).

A cursory glance at the current global state of affairs suggests that those who predict a “MOOTW-only” future may be shortsighted. The United States maintains extensive forces in South Korea in expectation of North Korean aggression. The People’s Republic of China continues to modernize its conventional and nuclear forces, and periodically threatens

Taiwan, which predictably engenders a military response from the United States. The Middle East remains a simmering cauldron of conflict with nations in the region harbor lasting animosities towards America and her allies, especially Israel. Even so, Douglas Lovelace suggests that "...large-scale war between great powers has become unlikely. American military prowess deters astute enemies from traditional aggression. Only a truly stupid opponent like Saddam Hussein would even consider it."<sup>2</sup> Unfortunately, the world is full of reckless people. Even rational actors may provoke war if their analysis is faulty. Future American involvement in a major regional conflict, while not probable, is *possible*, and cannot be dismissed.

The presupposition that low-intensity conflicts will monopolize both United States policy and military action has brought advocates for non-lethal military methods into the fray. These supporters of non-lethal weapons (NLWs) extol the virtues of future non-lethal technologies in MOOTW. They argue that NLWs fill the gap between the application of Flexible Deterrent Options (FDOs) and lethal conventional force. Non-lethal weapons are expected to provide the National Command Authorities and combatant commanders the ability to exercise coercive force greater than that derived from FDOs alone. The non-lethal aspect of that force is expected to yield additional dividends; for example, by allowing the United States to demonstrate restraint, American intervention could be made more politically palatable at home and abroad.<sup>3</sup>

Non-lethal weapons might very well prove appropriate in low-intensity conflicts, filling the space between FDOs and lethal force. The future use of these weapons would require extensive efforts and costs for development, acquisition, training, and incorporation into current force structure and doctrine.<sup>4</sup> If such an investment is to be made, consideration

must be given to the applicability of such weapons throughout the entire spectrum of military operations, not just MOOTW. Put simply, are NLWs a suitable component of U.S. military force in all-out war?

Assuming that the United States does enter a major regional conflict, NLWs could possibly provide a capability to the operational commander that bolsters the calls for their development and deployment. This paper will address this issue by analyzing the positive and negative impacts the use of NLWs would have on the following operational functions: command and control, fires, and intelligence.\* Before embarking on this analysis, a brief summary of important terms and concepts, and a survey of constraints on the use of NLWs under current international law will be presented.

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\*Operational force protection is addressed in depth by many advocates of non-lethal weapons in MOOTW. Operational logistics and maneuver are not addressed in this paper due to length constraints.

## **Concepts and Terms**

The U.S. Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict (SO/LIC) defines non-lethal weapons as those “that are explicitly designed and primarily employed so as to incapacitate personnel or materiel, while minimizing fatalities, permanent injury to personnel, and undesired damage to property and the environment....[non-lethal weapons] employ means other than gross physical destruction to prevent the target from functioning.”<sup>5</sup>

Envisioned NLWs are divided into two broad categories based on the proposed use of the weapon. Non-lethal anti-personnel weapons are designed to incapacitate enemy or non-combatant personnel. These proposed weapons may include, but are not limited to chemical agents, infrasound, pulsing light, lasers, and electromagnetic force, all of which affect brain/body physiology. Non-lethal anti-materiel weapons are designed to induce a “mission kill” on enemy weapon systems without affecting human operators. Such future weapons include combustion modifiers, super-lubricants, super-adhesives, super-caustics, depolymerizing agents, and conductive particles.<sup>6</sup> There is a proposed non-lethal means of affecting almost every weapon system existing today.

## International Law

The United States has ratified or agreed to abide by numerous conventions in the past century, many of which deal with the legality of certain types of weaponry or methods of employment. As technology progresses, these conventions and treaties will have a continuing and perhaps unforeseen influence on the development and utilization of NLWs.

The United States Senate ratified the Chemical Weapons Convention (CWC) after a great deal of debate and inclusion of specific exceptions for American armed forces. This Convention defines toxic chemicals as those chemicals whose toxic properties are intended as the primary means of inflicting temporary disabilities. The Convention expressly prohibits the use of toxic chemicals for any purpose.<sup>7</sup> The United States retained the right to use riot control agents for crowd control and other purposes; however, incapacitating agents such as those with calmative, soporific, or hallucinogenic effects have been banned.<sup>8</sup>

The Geneva Convention, Additional Protocol I of 1977 prohibits "indiscriminate attacks". These are defined as "those which employ a method or means of combat the effects of which cannot be limited [to a specific military objective]...and...are of a nature to strike military objectives and civilians or civilian objects without distinction".<sup>9</sup> Such a limitation could be very problematic for commanders considering the use of NLWs, especially in urban terrain. Most anti-personnel and anti-materiel NLWs would have an area effect, and would therefore affect both military and civilian objects or persons in the target area.

Another treaty adhered to by the United States is the Biological Weapons Convention. This agreement, ratified in 1975, bans development and production of biological agents "that have no justification for prophylactic, protective, or other peaceful

purposes".<sup>10</sup> As a result, research into proposed anti-materiel weapons such as fuel gelling and fuel/air filter-damaging microbes would be prohibited. The Assistant for Strategic Assessment at SO/LIC has stated that proposed non-lethal biological weapons violate international treaty and will not be pursued.<sup>11</sup>

The Environmental Modification Convention of 1977 prohibits weapons whose widespread or long-lasting environmental effects are used to destroy or damage the assets of another state.<sup>12</sup> This agreement could preclude the use of various anti-materiel NLWs as a means of area denial or damage to enemy infrastructure.

Most proposed anti-materiel and anti-personnel NLWs would be prohibited under existing treaties. The United States could argue that these treaties are primarily concerned with *lethal* uses of chemical and biological warfare, and were not intended to cover NLWs.<sup>13</sup> While the United States routinely reviews new weapons to determine their legal and ethical status with respect to international law<sup>14</sup>, other nations may not agree with the legal justification of their use. Law, as all human activity, is subject to interpretation; as a result, the use of NLWs in combat could open the United States to harsh criticism. Even with the best intentions, the United States could conceivably have to defend itself against charges of violating these treaties. The irony is that, under current international law, lethal force is more acceptable than proposed non-lethal force.<sup>15</sup>



## **Operational Command and Control**

Of the six operational functions, operational command and control is arguably the most important. It unites the other operational functions and, by maintaining their cohesion, enables the operational commander to achieve his objectives.<sup>16</sup> A key component of operational command and control is command and control warfare (C<sup>2</sup>W), which seeks to deny the enemy effective use of his operational command and control capabilities.<sup>17</sup> United States forces at war have used NLWs most extensively and most successfully in this arena.<sup>18</sup>

Command and control assets are often located in urban areas where lethal force could possibly produce great damage to civilians or their property. Non-lethal attacks presumably achieve identical "mission-kill" effects with less risk to non-combatants and their property, yielding political dividends to the United States. Another desired quality of non-lethal attacks is the decreased cost of reconstruction after the conflict.<sup>19</sup> Supporters of NLWs argue that reduced infrastructure reconstruction costs (often borne in part by the United States) could benefit post-hostilities operations and speed restoration of legitimate, friendly governments.<sup>20</sup>

An example of non-lethal C<sup>2</sup>W is the use of conductive particles against critical enemy power grids. These weapons, which are essentially spools of carbon-graphite wires, short-circuit transformers and controls, disabling power distribution. Such weapons were used in Operation Desert Storm against plants which provided power to the KARI integrated air defense computers. More recently, similar attacks were carried out in Serbia, targeting electrical distribution plants that provided power to various communications systems and air defense assets. These attacks, unlike the Iraqi missions, were not followed by lethal force.<sup>21</sup>

While many observers were suitably impressed by the technological wizardry of these weapons, these examples point out several of the problems inherent in non-lethal attacks. In both cases, the effects of the non-lethal attacks were short-lived. Iraqi forces reported that they were able to quickly remove the wires, reset circuit breakers and recommence operations at the affected sites. Serbian forces were able to restore most power several hours after the attacks.<sup>22</sup>

Another problem with NLWs was revealed in Operation Desert Storm. In general, it is difficult to determine if a NLW has achieved the desired effect. Since NLWs by definition do not achieve their effects through physical destruction, post-mission analysis is hampered. In Desert Storm, many of the power plants initially targeted with NLWs were subjected to later lethal force to ensure they were truly inoperative.<sup>23</sup> Most of these attacks were carried out with precision-guided munitions; specific components of the distribution plants were targeted to decrease the costs and time of anticipated post-hostilities repair. In fact, non-lethal attacks represented only a very small fraction of the total attacks against the Iraqi electrical distribution system.<sup>24</sup>

In addition, the limited "down-time" achieved by NLWs could force the operational commander to recommit forces to those targets for repeated strikes. This would increase the costs of the operation in terms of time and resources, and increase risk to friendly forces. After a non-lethal attack, pilots would face an enemy with a greater awareness of American targeting priorities, intentions, and methods. As a result, use of NLWs in the hopes of reducing enemy and civilian casualties could conceivably *increase* friendly casualties. If it is imperative that critical nodes of the command and control network be made inoperative for a substantial length of time, lethal attacks may be preferable to non-lethal ones.

## **Operational Fires**

Operational fires are designed to overwhelm the enemy's ability to concentrate maneuvering forces, with the intention of preventing him from delivering effective combat power at the decisive place and time.<sup>25</sup> Such fires were used extensively in Operation Desert Storm to achieve various purposes, including isolating the battlefield, interdicting uncommitted forces, disrupting logistical support, and preventing enemy forces from leaving the theater.<sup>26</sup>

Typically, lethal force is utilized in operational fires. Existing NLWs are relatively difficult to concentrate on a specific enemy force and are therefore generally used to supplement lethal fires.<sup>27</sup> This continues to be one of the principle arguments in favor of future NLWs -- that they "should be employed to enhance the effectiveness and efficiency of lethal weapons."<sup>28</sup> If the operational commander desires to interdict uncommitted forces, non-lethal operational fires using combustion modifiers against an armored division could stop those assets in their tracks. Lethal follow-on attacks could then be ordered at the discretion of the commander. Still, there are some problems inherent in this scenario.

Of primary concern is whether or not the non-lethal fire was actually effective. For example, combustion modifiers must be ingested by combustion engines in order to take effect; if these engines are not idling, or if countermeasure filters are in place, the targeted forces could simply delay movement until the weapons effects have dissipated. This scheme could be countered by periodic reapplication of the NLW; the increased risk to friendly forces raises the unpleasant possibility that a commander using NLWs might succeed in halting an enemy action with no enemy casualties while suffering several friendly ones. This would almost certainly reduce public support for non-lethal means and cause others to

question the commander's judgment. Alternatively, the duration of the weapon effect could be increased. This course of action presents a different dilemma. Assuming that the increased duration did not violate the spirit of the Environmental Modification Convention, the commander would have to address the possibility that his own forces might have to transit this same area at a later date, putting his assets at risk of residual non-lethal "friendly fire".

Another concern raised by this scenario is the moral aspect of using NLWs to "set-up" enemy forces for a lethal attack. If the great attraction of non-lethality is the preservation of human life, would the commander be obliged to warn the enemy that a follow-on lethal attack was imminent? DOD policy states that the presence of NLWs does not constitute "a higher standard for the employment of force",<sup>29</sup> but this is with respect to the decision to use lethal force *instead of* non-lethal force. The inadvertent deaths of dismounted soldiers tending incapacitated vehicles could rapidly negate political benefits accrued from the initial use of NLWs.

One widely criticized result of Operation Desert Storm was that a substantial number of Iraqi armored assets were still intact at the end of the conflict.<sup>30</sup> The destruction of those forces that were stopped was achieved with precision-guided lethal munitions. An advocate of NLWs has suggested that non-lethal attacks could have been more effective in preventing the return of these forces to Saddam Hussein's control. In his opinion, such attacks could have halted the retreating columns without the extensive destruction exhibited on the "Highway of Death" and elsewhere.<sup>31</sup> In reality, had NLWs, which "have relatively reversible effects on...materiel"<sup>32</sup> been utilized to stop the continued drive northward, a greater proportion of those assets would be in the Iraqi inventory today. When the United

States halted the retreating columns, many were already in Iraqi territory.<sup>33</sup> Iraqi technicians would have had the opportunity to reverse the effects of non-lethal attacks at a later date.

A possible benefit of using NLWs for operational fires is their potential role as a force multiplier. The use of NLWs of sufficient duration and reliable effectiveness against the enemy at his operational depth could allow lethal forces to be massed where they are most needed. This assumes that periodic reapplication of non-lethal force or lethal follow-on strikes would be unnecessary; if such measures were required, the use of NLWs would disperse rather than focus the application of force. Operational commanders would have to consider whether this potential benefit outweighed the negative aspects outlined above.

A final concern about NLWs is the possibility of escalation by the enemy. Despite the designation "non-lethal", the U.S. Department of Defense does not require that NLWs "have a zero probability of producing fatalities or permanent injuries"; their employment should only be expected to "significantly reduce" the occurrence of these effects<sup>34</sup>. An enemy may not be able to distinguish the effects of a NLW from those of a lethal weapon. If non-lethal anti-materiel weapons are used for operational fires and some fraction of the personnel thus exposed die, the enemy may interpret it as a lethal chemical attack. This could open the door to retaliation with weapons of mass destruction, escalating the conflict beyond what might have occurred had only lethal conventional munitions been used.

## **Operational Intelligence**

The establishment of a robust operational intelligence capability could address some of the problems cited above. Of critical importance will be the composition of enemy forces and their expected disposition at the commencement of hostilities. The planning for the employment of NLWs will also require in-depth environmental and climatic analysis. Intelligence should also provide expected enemy reactions to the use of NLWs; will enemy troops remain with their incapacitated vehicles or disperse to augment other enemy forces? If the effects of the weapons utilized are reversible, what capacity does the enemy have to overcome the non-lethal mission kill? Will enemy commanders understand the nature of the attack and respond appropriately, or could they misinterpret it and escalate the conflict? These last elements, requiring shrewd assessment of enemy morale, discipline, and doctrine are crucial. Once a major operation is embarked upon, the operational commander cannot change the employment of his own forces without substantial risk.<sup>35</sup> The decision to use NLWs in a major conflict cannot be made lightly; timely and accurate operational intelligence will weigh heavily on that decision.

Another critical element would be post-strike status of enemy systems targeted with NLWs.<sup>36</sup> While this borders on tactical intelligence, it is of critical importance to the operational commander. Of what use are operational fires or C<sup>2</sup>W if the impact on the operational capabilities of the enemy cannot be determined? The move towards network centric warfare may hold the key to this problem. The commander would need advanced sensors deep in enemy territory. Additionally, integrated reporting systems and increased national sensor capabilities would be required to provide the necessary information in a timely manner.

## **Conclusion**

Following the demise of the Soviet Union, the United States has found itself involved in several low-intensity conflicts which resulted in discouraging outcomes considering the military might the nation wields. These results have led numerous scholars to propose that NLWs should be fielded in expectation of more frequent "other than war" commitments. This paper has addressed whether such weapons could provide unique capabilities to United States forces in a major regional conflict.

One of the most attractive features of NLWs is the possibility of fewer battlefield casualties. This would make American military action more acceptable to potential coalition partners, the ever-expanding global audience and to the American people, who seem increasingly sensitive about casualties, whether friendly or enemy, combatant or non-combatant. Yet NLWs present some serious problems when one considers their employment.

Under current international law, development and use of most proposed NLWs would be prohibited. The weapons are viewed as too closely related to previously banned chemical or biological weapons, or they are seen as indiscriminate, affecting both military and civilian personnel and property in the area of their employment. This is a major stumbling block on the road to deployment of NLWs, but it is by no means the only one.

Non-lethal weapons have been used in the arena of operational C<sup>2</sup>W with mixed success. Though initially effective, the ease with which the effects were reversed and the inability to determine if the desired effect had been achieved required follow-on attacks with precision-guided lethal weapons to ensure the target was indeed inoperative.

The proposed use of NLWs for operational fires is even more problematic. Once again, inability to determine the effectiveness of the strikes and the possibility of reversing or countering the effects would seem to preclude the use of NLWs for fires. Reapplication of the non-lethal effect could increase risk to friendly forces. The commander could find himself in a moral quandary if destructive follow-on attacks designed to "pick off" the incapacitated vehicles resulted in significant enemy casualties. Finally, and most troubling, is the possibility that non-lethal attacks could be misinterpreted as lethal chemical warfare, which could result in retaliation with weapons of mass destruction.

If NLWs are incorporated into future forces, their planned use will have a significant impact on operational intelligence. Enemy forces would have to be analyzed to a greater degree so as to determine their vulnerability to NLWs effects. Environmental and climatic studies would be much more intensive in order to predict the extent and duration of the weapon effect. Increased human intelligence (HUMINT) would be required to better gauge enemy response to the use of NLWs. The determination of the effectiveness of non-lethal strikes would require extensive increases in the numbers and capabilities of sensor assets.

In the operational functions of C<sup>2</sup>W and fires, it seems clear that desired objectives could be (and in some cases, have been) more readily achieved through the use of precision-guided munitions. Increased guidance accuracy would reduce collateral damage and casualties, supplanting the proposed role of NLWs in a major conflict.<sup>37</sup> Time and money spent to develop NLWs for use in war may be better directed towards improving precision-guidance technology.

Non-lethal weapons, as envisioned in their future roles, have a seductive quality that belies the problems inherent in their development and deployment. The desire to reduce



casualties in conflicts creates a strong incentive to field NLWs. Simply having these weapons available, however, might increase demands for their use and further sensitize the public to the violence and bloodshed of war. This could weaken the resolve of political and military leaders to use overwhelming lethal force when required. As Clausewitz warned over 250 years ago:

“The fact that slaughter is a horrifying spectacle must make us take war more seriously, but not provide an excuse for gradually blunting our swords in the name of humanity. Sooner or later someone will come along with a sharp sword and hack off our arms.”<sup>38</sup>

When the United States embarks upon *war*, the decision has already been made to use lethal force to achieve the desired political objective. It behooves the National Command Authorities and the combatant commanders to ensure that the war comes to a rapid, favorable conclusion and that the result be decisive. Non-lethal weapons used in lieu of lethal ones do not increase the likelihood of these outcomes. It is lethal force that makes enemies bend to American will.

This author began this research effort with the expectation that non-lethal weapons could provide operational commanders unique capabilities in large-scale conflicts, and that the benefits of using these weapons in war would lend support to the mounting calls for their development and deployment. The results of this research reveal that these presuppositions were largely incorrect. Non-lethal weapons would create so many difficulties for the operational commander in large-scale conflict that their proposed utility is not commensurate with the costs of development and deployment. Some correctly assert that in war, NLWs should play only a secondary role in support of lethal weapons.<sup>39</sup> The above analysis suggests that their role should be very small indeed.

## NOTES

<sup>1</sup> Martin Van Creveld, quoted in Nick Lewer and Steven Schofield, Non-Lethal Weapons: A Fatal Attraction? (London: Zed Books, 1997), 21.

<sup>2</sup> Douglas C. Lovelace, Jr. and Steven Metz, Nonlethality and American Land Power: Strategic Context and Operational Concepts (Carlisle Barracks, PA: U.S. Army War College. Strategic Studies Institute, 1998), 6.

<sup>3</sup> See Malcolm H. Wiener, Non-lethal Technologies: Military Options and Implications (New York: Council on Foreign Relations, 1995), 2-7; Malcolm Dando, A New Form of Warfare: The Rise of Non-Lethal Weapons (London: Brassey's, 1996), 1-226; and Lexi Alexander and Julia L. Klare, The Role of Non-Lethal Technologies in Operations Other Than War (Alexandria, VA: Institute for Defense Analysis, 1996), 1-30.

<sup>4</sup> John L. Barry et al., Nonlethal Military Means: New Leverage for a New Era (Cambridge, MA: Harvard University Press, 1994), 10-11.

<sup>5</sup> Assistant Secretary of Defense for Special Operations and Low-Intensity Conflict, "Policy for Non-Lethal Weapons", DOD Directive 3000.3, 9 July 1996, <<http://web7.whs.osd.mil/text/d30003p.txt>> (3 December 1999), p 1 of 4.

<sup>6</sup> Dando, 11-12.

<sup>7</sup> Ibid., 186.

<sup>8</sup> Margaret-Anne Coppernoll, "Ethical and Legal Principles Concerning the Use of Non-Lethal Weapons," in Military Philosophy and Ethics, ed. Edwin R. Micewski and Michael H. Oppenheim [book on-line] (Monterey, CA: Naval Postgraduate School, 1999, accessed 14 January 2000); <<http://nsa.nps.navy.mil/Publications/Micewski>>, 88.

<sup>9</sup> Lewer and Schofield, 84.

<sup>10</sup> Coppernoll, 85.

<sup>11</sup> Clifford Beal, "Non-Lethals: Next Step," International Defense Review, 1 December 1997, Jane's Information Group Limited/Editorial, Lexis-Nexis. (Dayton, OH: Lexis-Nexis, (23 November 1999)), 2.

<sup>12</sup> Coppernoll, 85.

<sup>13</sup> Lewer and Schofield, 131.

- <sup>14</sup> Coppernoll, 80.
- <sup>15</sup> David A. Morehouse, Non-Lethal Weapons: War Without Death (Westport, CT: Praeger, 1996), 107.
- <sup>16</sup> Milan Vego, On Operational Art (Newport, RI: U.S. Naval War College, Joint Military Operations Department, 1999), 269.
- <sup>17</sup> Vego, 276.
- <sup>18</sup> Barry et al., 7.
- <sup>19</sup> ASD-SO/LIC, 2.
- <sup>20</sup> Amy M. Bouchard et al., quoted in Greg R. Schneider, Nonlethal Weapons: Considerations for Decision Makers (Urbana, IL: University of Illinois at Urbana-Champaign, Program in Arms Control, Disarmament, and International Security, 1997), 7.
- <sup>21</sup> David A. Fulghum, "Electronic Bombs Darken Belgrade," Aviation Week and Space Technology, 10 May 1999, 34.
- <sup>22</sup> Ibid.
- <sup>23</sup> Lewer and Schofield, 66.
- <sup>24</sup> Vego, 305.
- <sup>25</sup> Ibid., 289.
- <sup>26</sup> Ibid., 296.
- <sup>27</sup> Ibid., 293.
- <sup>28</sup> ASD-SO/LIC, 2.
- <sup>29</sup> Ibid.
- <sup>30</sup> Vego, 307.
- <sup>31</sup> Timothy J. Lamb, Emerging Nonlethal Weapons Technology and Strategic Policy Implications for 21<sup>st</sup> Century Warfare (Carlisle Barracks, PA: U.S. Army War College, 1998), 22.
- <sup>32</sup> ASD-SO/LIC, 2.

<sup>33</sup> Vego, 307.

<sup>34</sup> ASD-SO/LIC, 2.

<sup>35</sup> Vego, 283.

<sup>36</sup> Edward P. O'Connell and John T. Dillaplain, "Nonlethal Concepts: Implications for Air Force Intelligence", Air Power Journal, 1994,  
<http://www.airpower.maxwell.af.mil/airchronicles/apj/apj94/dil.html>> (23 November 1999), 6.

<sup>37</sup> Barry et al., 14.

<sup>38</sup> Carl Von Clausewitz, On War, trans. and ed. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 260.

<sup>39</sup> Vego, 308; Lovelance and Metz, 16.

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